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Full Length Research

Use of Water Hyacinth as Feed Stuff for Animals in Niger Delta, Nigeria

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Water hyacinth has been proven to be a viable raw material for local economy capable of generating significant economic ventures in localities and regions where they occur all over the world. This is particularly true of the Niger Delta region where the need to utilize the weed as a source of raw material for producing other goods is needed. Furthermore, this will serve as a means of indirectly ensuring that the region is economically empowering the citizens by making sure that the aquatic environment is devoid of the nuisance of the weed. This study was experimental using pigs as samples and practically experimented on the use of the weed as an ingredient for pig's feed stuff. The nutrient profile of the weed was also analyzed to determine its proximate nutritional value as a basis for developing a comparison with other conventional animal feed production ingredients. The findings showed that no cases of anti-nutritive or toxic substances were recorded in water hyacinth. Some of the essential amino acid levels in water hyacinth were below the requirement for livestock and poultry as recommend by FAO. The water hyacinth protein has very high digestibility and utilization by animals. The findings of the study also showed that the pigs in dietary treatment IV had significantly lower feed cost/kg of body weight gain than pigs in the control diet I and the other two dietary treatments. The feed cost/body weight gain was highest for the control diet I (₦132.58) and lowest for treatment IV (30%WH- ₦73.50). Based on the findings; recommendations were made as to how best to utilize the method to boost pig production in the region, increase protein intake of the citizens as well as an indirect environmental way of controlling the environmental menace of the water hyacinth in the Niger Delta region.

Key-words: Use, Water Hyacinth, Feed Stuff, Animals, Niger Delta.

INTRODUCTION

Water hyacinth is generally considered a nuisance weed. The plant can grow and survive in lakes, streams, rivers, ponds, ditches and in any water ways. It obtains its nutrients from the water column. Water Hyacinth (*Eichhornia crassipes*) can live and reproduce floating freely on the surface of fresh

waters or can be anchored in mud (Diamond, 2002). Plant size ranges from a few inches to a metre in height. Its rate of proliferation is extremely rapid and can spread to cause infestations over large areas of water causing a variety of problems. Consequently, its challenges and problems seem to undermine its perceived benefits. However through research, the water hyacinth has been proven to be a viable raw material for local economy capable of generating significant economic ventures in localities and regions where they occur all over the world (Nagendra and Goppal, 2001). One of the most important components of the water hyacinth control strategy was the processing of the harvested water hyacinth into various economic products. Water hyacinth harvests have been put into valuable uses in several countries and the methods of converting the plant material into valuable products have emerged. Apart from its ornamental value, the plant has been found useful as a source of animal feed and as a source of fertilizers for use in agriculture (Chinda et al., 2002). The effective utilization of the weed in the various afore-mentioned ways will greatly allay the fears of the plant's speedy growth and covering of the surfaces of creeks, lakes and rivers in the Niger Delta region and beyond. The aquatic environments of the Niger Delta region will become sanitized of the menace and nuisance impacts of the weed. Thus, utilizing water hyacinth economically shall definitely result in a win-win situation for the Niger Delta Region in Nigeria. Some of the positive attributes of water hyacinth that makes it suitable as an economic plant are: It's abundant availability in the region, It grows readily without any need for sowing, weeding or fertilizing, It does not require any land space and to harvest it is to do an environmental favour. It grows vigorously and abundantly to produce a large biomass, It has leaves rich in protein, being as valuable as that in potatoes or clover. Has a high potassium concentration, tough, fibrous roots that purify water by absorbing the nitrogen and phosphorus on which it thrives. It also absorbs toxic chemicals such as lead, mercury (NEST, 1998) etc. In this research, the evaluation of the nutrient profile of the water hyacinth will be carried out to ascertain its suitability as feed stuff.

Method of Study

The experiment was carried out using pigs as the organisms of the study. A private Farm, Universal Farms Limited, located in Oghege village, Kilometer 12, Benin- Sapele Rd, in Ikopa Okha LGA of Edo State Nigeria was used as the facility for the experiment. The water hyacinth was sourced from Ologbo River in Edo State. The reason for the choice of this location was that the river was relatively devoid of hydrocarbon pollutants and other industrial polluting discharges that characterize most environment of the Niger Delta, particularly around where oil was produced. It was also believed that water hyacinth from Ologbo river will have less toxicants and anti-nutritive substances that are usually associated with the weed growing in highly polluted waters (NEST, 1998).

Experimental Design and Technical Procedure

Twenty four (24) large white weaner pigs of both sexes with initial live weight of 10-12kg were housed in conventional standard pig pen under intensive system of management and later were randomly allocated to four dietary treatments in a completely randomized design (CRD) and each treatment replicated thrice with two pigs per replicate (Ajuogu et al., 2015).

The analysis was based on linear model:

$Xij = \mu + Ti + Eij$

Where μ = unknown constant, the population mean common to all treatments.

Ti = Treatment effect

Eij = Error term

Xij = Value of any observation

A Proximate Evaluation of the Nutrient Profile of Water Hyacinth

The nutritional value of water hyacinth varies depending on the age, part of the plant, nutrient status and contamination of the surrounding water body (Dymond, 2002). According to (FAO, 1998), the energy content varies from 2300-2600 DEKcal/kg, crude protein (20-26%), crude fibre (14-16%), dry matter (10.4 - 17.2%), ether extract (3.92-5.85%) and ash (10-14%). The proximate analyses, essential amino acids profile and mineral composition of water hyacinth was presented in Tables 1, 2 and 3 respectively. The data in Table 1 shows the result of the proximate analysis carried out on samples of water Hyacinth collected from Ologbo River in Edo state and analyzed at the Rivers State University, Environmental Laboratory,

Table 1. Proximate Composition of Water Hyacinth.

SN	NUTRIENTS	% COMPOSITION
1	Energy (DE Kcal / kg)	1.85
2	Ether Extract(Lipid0	1.95
3	Protein	13.15
4	Crude Fibre	12.4
5	Ash	14.10
6	Dry Matter	5.02
7	Moisture Content	94.08

Source (FAO, 1998).

Table 2. Essential Amino Acid (EAA) Composition of Water Hyacinth (g/100 Pure Protein).

S/N	ESSENTIAL AMINO ACID	% COMPOSITION
1	Histidine	1.18
2	Isoleucine	0.42
3	Lysine	1.00
4	Methionine	1.76
5	Phenylalanine	1.22
6	Threonine	0.36
7	Valine	1.06
8	Alamine	1.65

Source (FAO, 1998).

Table 3. Mineral Composition of Water Hyacinth (g/100 Pure Protein).

S/N	MINERALS IN WATER HYACINTH	% COMPOSITION
1	Na (%)	0.02
2	K (%)	4.28
3	P (%)	0.44
4	Ca (%)	2.63
5	Fe (ppm)	1.16
6	Mg (ppm)	190.5
7	Z n (ppm)	77.3

Source: (FAO, 1998).

Port Harcourt (2017).

Findings and Discussion on Nutrient Profile Analysis Result of Water Hyacinth

From the available literature, no cases of anti-nutritive or toxic substances have been recorded in water hyacinth. Some of the essential amino acid levels in water hyacinth are below the requirement for livestock and poultry as recommend by (FAO, 1998). Therefore, there was need for supplementation with synthetic sources to compensate for the deficiencies. It was reported by (Oyakawa, and Griffiths, 1996) that water hyacinth

Table 4. Percentage Ingredient and Chemical Composition of Experimental Diets.

Parameters	Dietary Treatments			
	I(control)	II	III	IV
Maize	46	46	46	46
Soya Bean Meal	30	20	10	0
Water Hyacinth	0	10	20	30
Palm Kernel Cake	20	20	20	20
Borne Meal	2.50	2.50	2.50	2.50
Salt	0.50	0.50	0.50	0.50
Vitamin / Mineral Mix	0.50	0.50	0.50	0.50
DL - Methionine	0.25	0.25	0.25	0.25
DL- Lysine	0.25	0.25	0.25	0.25
TOTAL	**100**	**100**	**100**	**100**
Chemical Composition				
Crude protein (%)	20.80	18.91	17.02	15.12
Energy (DEKcal/kg)	2824.64	2807.61	2790.58	2773.55
Either extract (%)	4.09	4.23	4.37	4.52
Crude fibre (%)	5.27	6.12	6.96	7.81
Calcium	1.03	1.27	1.52	1.76
Phosphorus (%)	0.63	0.61	0.92	0.91
Lysine (%)	1.33	1.22	1.23	1.02
Methionine (%)	0.59	0.63	0.71	0.77

❖ Vitamin / Mineral Premix (Animal Care Product), Adapted from (Akovbovbo et al.,2012).
The following were present 1kg Vit A – 10,000,000 I.U, D -2,000,000I.U, B_1-0.75kg, Nicotinic acid – 25g, Calcium panthothenate 1.5g, B_{12} - 0.015g, K-2.5g, Biotine -0.4g, Folic acid - 8g, Iron-32g, Iodine -0.8g, Manganese -64g and Zinc – 40 (Akovbovbo,et al.,2012).

protein has very high digestibility and utilization by animals. Further report by (Oyakawa et al., 1996) opines that dehydration process enhances the nutrient density of water hyacinth.

Suggestions on Nutrient Profile Analysis Result of Water Hyacinth

This result therefore justify a recommendation for the trial of water hyacinth as a supplementary feed ingredient for animal production, which was carried out in this study. In this research pigs were the animals of choice for the experiment due to their high feed conversion ratio, disease resistance and most importantly it is a source of meat that is widely consumed within the medium and low income class of the Niger Delta Region Nigeria.

Preparation Processes and Procedures of Water Hyacinth as a Feed Ingredient for Pig Production

The water hyacinth plants were harvested lush green using local canoe. The plants were washed clean with the river water and packed in jute bags before taking them ashore. The root and petioles were immediately removed and discarded. After washing, the leaves were immediately chopped to an average size of about 2cm in length, sun dried until crispy while still retaining the greenish colouration and then later grounded to pass 0.5mm mesh screen. The ground leaves were thereafter incorporated into the basal diet at different levels of inclusion to replace Soya Bean Meal (SBM) weight for weight. A balanced basal diet was formulated (treatment I) with SBM as the protein source which is the control. The Soya Bean Meal (SBM) in the basal diet was substituted with different levels of water hyacinth (kg of kg) for the other treatments. For example; Treatment II 10% SBM replacement with water hyacinth, Treatment III 20% SBM replacement with water hyacinth and Treatment IV 30% SBM replacement with water hyacinth.

All diets were supplemented with vitamin/mineral premix to meet (FAO, 1998) nutrient requirement for pigs (Table 4). Routine management operations such as regular cleaning and disinfection of pens,

Table 5. Performance Characteristics of Weaner Pigs Fed Graded Levels of Water Hyacinth.

Parameters	DIETARY TREATMENT			
	I (Control)	II	III	IV
Av. initial weight (kg)	10.34	10.28	10.25	10.47
Av. final weight (kg)	31.93	31.77	31.58	31.77
Av. Total weight gain (kg)	21.59	21.48	21.33	21.30
Av. weekly weight gain (kg)	21.16 ± 0.36	2.15 ± 0.38	2.13 ± 0.3	2.13 ± 0.28
Av. daily weight gain (kg)	0.308 ± 0.09	0.307 ± 0.08	0.305 ± 0.08	0.30 ± 0.10
Av. Total feed initial (kg)	54.71	55.85	58.01	60.03
Av. weekly feed intake (kg)	5.47 ± 0.16^{c}	5.58 ± 0.13^{c}	5.80 ± 0.12^{b}	6.00 ± 0.18^{a}
Av. daily feed intake (kg)	0.78 ± 0.14^{c}	0.80 ± 0.14^{c}	0.829 ± 0.10^{b}	0.86 ± 0.12^{a}
Av. weekly FCR (Feed: gain)	2.14 ± 0.08	2.19 ± 0.08	2.29 ± 0.06	2.37 ± 0.12
Av. protein intake	1.14 ± 0.10	1.06 ± 0.13	0.99 ± 0.12	0.91 ± 0.11
Protein efficiency ratio	2.24 ± 0.16	2.40 ± 0.18	2.56 ± 0.12	2.78 ± 0.14
Mortality (1%)	0	0		
Cost/kg weight gain (₦)	132.58^{a}sem±0.11	113.86^{a}sem±0.16	94.86^{c}sem±0.14	73.50^{d}sem±0.13

Within row, mean ± SEM with different superscripts differs significantly at ($P < 0.05$.).Adapted from (Akovbovbo,et al., 2012).

provision of feed and water were carried out as at when due.

Data Collection and Analysis

Production parameters data i.e. feed intake, body weight gain/loss, feed conversion ratio, protein efficiency ratio, mortality, feed cost / kg, body weight gain were collected and subjected to analysis of variance (ANOVA) and their means separated using Duncan Multiple Test Range DMTR (Duncan, 1955).

Results of Animal Performance Characteristics

The effect of treatment (Water Hyacinth) on performance parameters are presented in Table 5. In animal studies, growth and performance are important indices in evaluating productivity. The growth and performance indices of the pigs evaluated in this study included feed intake, weight gain, feed conversion ratio, protein efficiency ratio and feed cost per kg of weight gained as show in Figures 1, and 2 (Akovbovbo,et al., 2012).

Analysis of Variance Result

The result of the analysis of variance showing the influence of water hyacinth on average final weight, average total weight gain, average weekly weight gain, average daily weight gain, was not significantly different ($P > 0.05$) between the control and the treatment groups. There was mild insignificant progressive reduction of weight with increasing level of water hyacinth in the ration to compensate for reduction in the energy intake. However there was significant difference ($P < 0.05$) in the average weekly feed intake and average daily feed intake among the treatment groups. The mean weekly feed intake for pigs on the control diet (0%WH) was 5.471kg and ranged from 5.58kg, 5.80kg and 6.00kg for diets II, III and IV respectively. The feed intake for the pigs on diet IV (.30WH) and diet III 20% differed significantly ($P<0.05$) from others, but there was no significant difference ($P>0.05$) between diets II and I.

From Table 5 there was no significant influence of the treatments on Average weekly Feed Conversion Ratio (feed: gain) among the treatment groups ($P>0.05$). Slight insignificant increase was observed with increasing levels of water hyacinth with highest and lowest in treatment IV (2.37) and I (2.14) respectively. Also weekly protein intake revealed no significant influence ($P>0.05$) among the treatment groups. There was a mild insignificant progressive decrease in protein intake as water hyacinth increases. Protein efficiency ratio had no significant difference between the treatment groups ($P >0.05$). Treatment IV had the highest and Treatment I the least protein efficiently ratio; see Figures 3, and 4

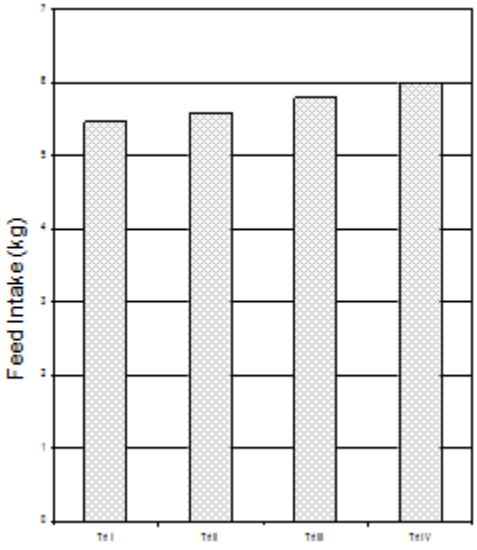

Figure 1. Average Weekly Feed Intake (kg) of Pigs Fed (Kg) of Pigs. (Fed Graded Levels of Water Hyacinth).

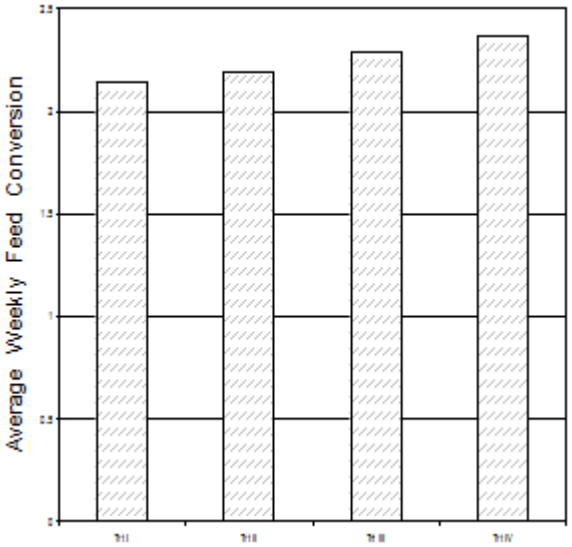

Figure 3. Average Weekly Feed Conversion ratio of Pigs Fed (Kg) of Pigs (Fed Graded Levels of Water Hyacinth).

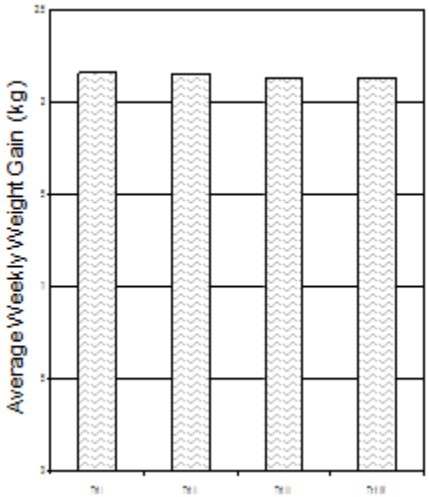

Figure 2. Average Weekly Weight Gain of Pigs Fed (Kg) of Pigs. (Fed Graded Levels of Water Hyacinth).

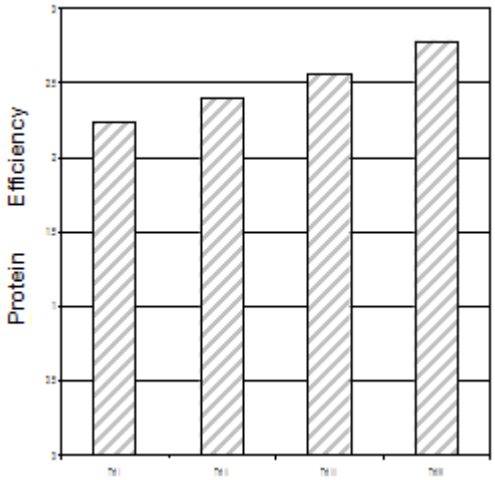

Figure 4. Protein Efficiency of Pigs. (Fed Graded Levels of Water Hyacinth).

respectively (Akovbovbo, et al., 2012). No mortality was recorded among the treatment animals.

CONCLUSION

From the result obtained from the experiment the following conclusion was drawn:

- The findings of the study also showed that the pigs in dietary treatment IV had significantly lower feed cost/kg of body weight gain than pigs in the control diet I and the other two dietary treatments.
- The feed cost/body weight gain was highest for the control diet I (N132.58) and lowest for treatment IV (30%WH- N73.50).
- There was a linear decrease in feed cost/weight gain with increasing level of water hyacinth substitution for soya bean meal. The result

agreed with the report of (Henry and Dyfed, 2008) that the nutritionist must not only look at feed consumption and weight gain, but also the efficiency of feed utilization and the cost effectiveness of using the feed.

RECOMMENDATIONS

- It can be concluded from the findings of this study that one of the real long term, economically viable and environmentally friendly solution to the water hyacinth menace was to utilize it as an ingredient in swine (pigs) diets.
- This technique to convert it to swine feed offers a positive hope for a viable long-term control measure, since it has a lot of positive economic benefits without polluting the environment. This will help in re-cycling water hyacinth into a useful feed resource, thus turning it from being a serious environmental nuisance to a very useful raw material to enhance protein availability to the people of the Niger Delta in particular and Nigeria, in general.
- The commercial conversion of this aquatic plant as an economically beneficial means of indirectly controlling this plant in Niger Delta should be explored.

REFERENCES

Ajuogu KP, Akovbovbo G and Ekine AO (2015). Organs weight and Carcass Quality and Characteristics of Growing Pigs Fed Graded Levels of Water Hyacinth (*Eicchornia Crassipes)*. Journal of Global BioSciences; 4 (1): 1871-1876.

Akovbovbo G, Ajuogu PK, Akankali JN, George OS and Yahaya MA (2012). Performance Evaluations of Weaner Pigs Fed Graded Levels of Water Hyacinth *(Eicchornia Crassipes*).Waste Management and Bio-resource Journal, Vol. 2, pp.8-13.

Chinda AC, Braide SA, Opusunju SI and Barango FSC (2002). The distribution of water hyacinth (*Eicchornia Crassipes*) in Rivers state: A study commissioned by Rivers State Government. pp. 10-40.

Duncan DB (1955). Multiple Range and Multiple: In Encyclopedia of Research Design, 11, 1-5.Sage Research Methods U.S.A.

Dymond EA (2002). Water hyacinth In: Van Driesche, Biological Control of Invasive Plants in the Eastern United States. USDA Forest Service Publication FHTET-2002-04, 41-64.

Henry E.A and Dyfed FC (2008). The Water hyacinth (*Eicchornia crassipes*); A Cinderella of Plant World. Mack publishers Inc. New York. pp530.

Nagendra PG and Goppal MJ (2001). Strategies for economic utilization of aquatic weeds of Kerala. Proceedings of the National Seminar on Kuttanad Development Edathua, Alleppey, India, 22-24.

Nigerian Environmental Study and Action Team (NEST, 1998). Nigeria's Threatened Environment: A National Profile, NEST, Ibadan, Nigeria.

Oyakawa MH and Griffiths MW (1996). Biological Control of Weeds: A World Catalogue of Agents and their Target Weeds. 4th edition. ABI Publishing, Oxford, pp. 90-96.

Rivers State University of Science and Technology Laboratory (2017).

United Nations Environment Programme and Food and Agriculture Organization (1998). Fisheries and Aquaculture Technical Paper no. 185 and UNEP Regional Seas Report and Studies no. 523.